

Aerospace Technology

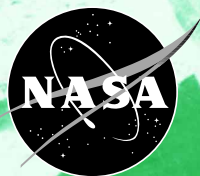
INNOVATION

NASA Feeds the Hungry

**Robot Will Assist the Elderly
and Infirm**

**Heart Ticks Right with NASA
Technology**

**"Food Grade" Anti-icing
Fluid Reduces Auto
Rust Too**



INNOVATION

Aerospace Technology

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About the Cover: A group of refugee women watch as a Solar Cooker International (SCI) trainer demonstrates placing food in a solar cooker.

On-Line Edition: Go to <http://nctn.hq.nasa.gov> on the World Wide Web for current and past issues.

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COMMERCIAL DEVELOPMENT MISSION UPDATE

Date*	Flight	Payload	Sponsor/Coordinator
7/97	STS-94 MSL-01 Reflight (launched July 1997)	Astro-Plant Generic Bioprocessing Apparatus Vapor Diffusion Apparatus (Microgravity Research including protein for structure-based drug design related to Chagas' Disease)	BioServe Space Technologies Center for Macromolecular Crystallography
9/97	STS-86** Shuttle/Mir-07	Commercial Generic Bioprocessing Apparatus Liquid Phase Sintering (samples going to Mir)	BioServe Space Technologies Consortium for Materials Development in Space
1/98	STS-89** Shuttle/Mir-08	ASTROCULTURE(TM) X-ray Detector Test	Wisconsin Center for Space Automation and Robotics Center for Macromolecular Crystallography

Key STS—Space Transportation System

*As of July 9, 1997

**These payloads go over to Mir for extended operations for about four months and return on the next Shuttle/Mir Mission.

WELCOME TO INNOVATION

An Opportunity to Access NASA Technologies

by Robert Norwood

ON SEPTEMBER 22–24 IN BOSTON'S HYNES Convention Center, NASA will hold its eighth annual technology transfer conference, Technology 2007. Sponsored by NASA, NASA Tech Briefs magazine, the Federal Laboratory Consortium, and the Technology Utilization Foundation, Technology 2007 is designed to help U.S. businesses solve design challenges, develop new commercial products, find strategic partners, and improve their productivity and competitiveness.

This year, Technology 2007 is co-located with the Society for Optical Engineering (SPIE) Photonics East and Electronic Imaging conferences, giving attendees access to over 80,000 square feet of exhibits from some 300 government labs, universities, and high-tech companies. The three events will share a conference program focused on commercially-promising advances in Manufacturing/Materials, Laser/Optics, Environmental Technology, and Sensors/Instrumentation. Among the technologies, NASA will present: a new solventless coating process; a highly sensitive tool for detecting wear in metallic parts; a holographic system for environmental remote sensing; and a high-power/low-cost semiconductor laser with applications in optical communications.

NASA will also have an updated version of the "NASA Technology Solutions-Sharing Aerospace Technology with America" CD-ROM which made its debut at Technology 2006.

Daily plenary sessions will feature top-name speakers such as David Campbell, President of BBN Technologies, one of the inventors of the Internet and a recent inductee into the Space Technology Hall of Fame for work on NASA's pioneering ACTS communications satellite program. A highlight of the Tuesday September 23 plenary will be a NASA presentation on the Next Generation Internet Initiative, which seeks to

speed electronic communications by more than a thousand times over current rates. This will be followed by a breakout session where companies can learn specifics about the initiative and how they can participate.

More than 8,000 business managers, senior engineers, and entrepreneurs from across the nation are expected to attend the combined events. In past years, more than half of the attendees have obtained licensing, cooperative R&D, or other technology transfer and commercialization agreements as a direct result of their attendance.

Technology 2007 represents one component of NASA's broader marketing strategy. That strategy is focused on utilizing a number of innovative marketing tools to reach new sectors of industry. Modeled along

efforts pursued by the private sector, NASA's strategy is focused on integrating public relations, advertising, direct mail, and trade shows to convey the message that NASA is a technology resource that companies should tap into.

This represents a departure from NASA's old way of doing business.

Rather than just rely on serendipitously getting the word out that NASA is seeking partners to commercialize its technology, we are targeting key venues that decision-makers within industry utilize as a normal course of business. This includes exhibiting at trade shows such as the National Design and Engineering show, the key show for reaching the manufacturing sector, and the product designers. It also means running public service messages in magazines like *Design News*, *Tech Briefs*, and *Intech* to aggressively seek out industry partners.

I believe that Technology 2007 provides excellent opportunities for those searching for new technologies, product ideas and/or partnerships. I hope to see you at Technology 2007.

For Technology 2007 registration details, visit the conference web site at HYPERLINK <http://www.abptuf.org/T2007> or contact the Technology Utilization Foundation, 317 Madison Ave., Suite 1900, New York, NY 10017. Phone 212/490-3999; Fax 212/986-7864.

TECHNOLOGY 2007 IS DESIGNED TO
HELP U.S. BUSINESSES SOLVE DESIGN
CHALLENGES, DEVELOP NEW
COMMERCIAL PRODUCTS, FIND STRATEGIC
PARTNERS, AND IMPROVE THEIR
PRODUCTIVITY AND COMPETITIVENESS.

For information about the CD-ROM, contact the National Technology Transfer Center. ☎ 800/678-6882. Please mention you read about it in *Innovation*.

TECHNOLOGY TRANSFER

Solar Data Aids Hunger Solution

WOMEN AND CHILDREN IN EAST AFRICAN refugee camps must often search for hours to find enough firewood to cook. In some African cities, the poor spend more than half their annual income on cooking fuel.

Volunteers are using data generated by NASA's Mission to Planet Earth program, a long-term, international study of Earth as a global environmental system, to help East Africans learn to cook with solar energy. "We have found the NASA Surface Solar Energy (SSE) data set to be a wonderful resource, providing reliable data for any location on Earth," said Jay Campbell, a director for Solar Cookers International (SCI), a non-profit Sacramento, California, group that promotes solar cooking technology.

SCI manages solar cooking training in eight refugee camps, as well as less developed areas. In addition, SCI responds to information requests worldwide. Campbell said the NASA SSE data set created by Langley Research Center and Analytical Services and Materials, Inc., Hampton, Virginia, is invaluable to SCI in choosing sites where solar cooking will be most useful to the local population. "This quality of information is simply unavailable from other sources and allows us to make better decisions for our consultations and project plans," he said.

From a Kenyan refugee camp, a solar cook proudly displays her freshly cooked pasta.



A woman cleans her cooker after use.

Solar cooking is a clean, safe, convenient, relatively cheap, heat source that reduces smoke, air pollution and deforestation. It also may be used to pasteurize drinking water to help prevent disease.

Dr. Charles Whitlock, the Langley senior research scientist who led the SSE data set development team, said NASA hopes the data may be used to improve designs for solar-assisted electricity systems to provide power to a fraction of the forty percent of the world that has none. Whitlock expects current SSE data to lead to more efficient design of solar-assisted electricity systems for homeowners, communications stations, oil platforms and weather-monitoring instruments.

SSE data set is available via Internet at http://eosweb.larc.nasa.gov/DATDOCS/Surface_Solar_Energy.html Users enter their latitudes and longitudes to receive a one-page printout on the available solar energy in their areas. The global data set, a synthesis of information from several weather satellites, contains 52 monthly averages compared to traditional, individual measurements from isolated surface sensors.

"Release of this data to the Internet will help us answer questions faster and will allow for more specific advice to be given," Campbell said. "Solar cooking provides tremendous health, environmental and financial benefits to those who can use it. Better identification of target areas will help spread this powerful tool farther and faster than before." * ❄

For more information, contact Charles Whitlock at Langley Research Center.
☎ 757/864-5675, 📠 757/864-7996, ✉ c.h.whitlock@larc.nasa.gov
Please mention you read about it in *Innovation*.

Robot Will Assist the Elderly and Infirm

U.S. SENATE MANUFACTURING TASK FORCE members saw first-hand the effectiveness of public/private sector commercialization partnering during a Capitol Hill visit from HelpMate Robotics Inc.'s (HRI) HelpMate courier robot—a high technology product that, with the help of NASA technologies, will evolve into a robot capable of assisting the elderly and infirmed.

NASA Administrator Daniel Goldin joined U.S. Senator Joseph Lieberman (D-Connecticut), Task Force co-chairman; HRI Chairman Dr. Joseph Engelberger, National Technology Transfer Center (NTTC) President Dr. David Moran and UNISPHERE President Allen Paul in demonstrating the new robotic technology at a recent Task Force briefing.

Senator Lieberman said the HelpMate project illustrates the complex process of innovation and highlights the successes that can be achieved through key partnerships.

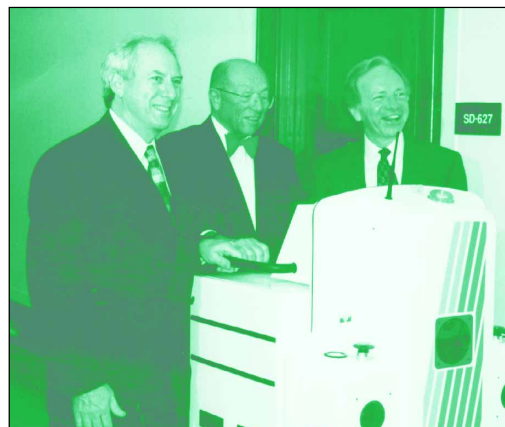
"I believe the federal government should continue to play an important role in the nurturing of science and technology," Senator Lieberman said. "This support must take into account the inherent complexity of the innovative cycle and the new reality of the ultra-competitive global economy. Accordingly, scarce federal funds should be leveraged through cooperative partnerships between industry [sic], universities and federal labs."

Moran illustrated Senator Lieberman's point on the importance of partnerships through a presentation on NASA-funded NTTC activities. Moran said NTTC is a full-service technology commercialization center offering U.S. industries a wide range of services from professional development courses in technology commercialization and technology assessments to public/private sector partnership opportunities and access tools to technology information from more than 700 federal laboratories.

NTTC and UNISPHERE, an NTTC partner that matches high-tech U.S. products with overseas markets, are working with HRI to help develop NASA technology for the next generation of working robots. Paul said UNISPHERE's work with HRI has led to exciting possibilities that demonstrate his group's goal to help make U.S. companies competitive worldwide.

The Task Force saw a demonstration of HRI's courier robot. More than 80 U.S., 11 European and 18 Japanese hospitals are employing HelpMates to transport routine materials. HelpMate avoids fixed or moving obstacles as it travels. It calls and rides elevators by itself and communicates its instructions in any language. A HelpMate relieves valuable professionals for more productive activities for about \$6 per hour.

HRI and NASA are developing the next-generation robot, the two-Armed, Mobile, Sensate, Research Robot. While NASA will use the prototype for terrestrial experiments for the Space Station, HRI sees it as an elder care robot that will help older people care for themselves, rather than be hospitalized, for about \$1 per hour. ✱



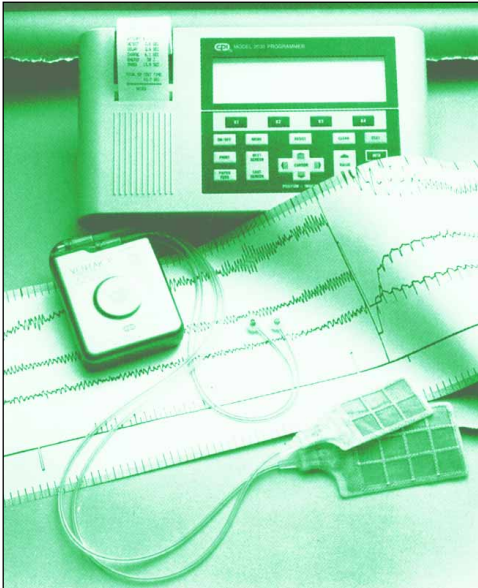
NASA Administrator Daniel Goldin, HRI Chairman Joseph Engelberger and U.S. Senator Joseph Lieberman with the HelpMate Courier Robot at a recent U.S. Senate Manufacturing Task Force briefing.

For more information about HelpMate, contact Dr. Joseph Engelberger. ☎ 203/798-8988, ☎ 203/791-1082. For more information about NTTC, ☎ 800/678-6882 or visit <http://www.nttc.edu> For more information about UNISPHERE, contact Karen Friedman. ☎ 202/588-9000, ☎ 202/588-9200 or visit <http://www.Unisphere.com> Please mention you read about it in *Innovation*.

Heart Ticks Right with NASA Technology

A NASA-DEVELOPED IMPLANTABLE CARDIAC defibrillator saved so many lives that a recent National Institutes of Health (NIH) clinical trial comparing it to antiarrhythmic drug treatment was stopped early.

The National Heart, Lung and Blood Institute (NHLBI) of NIH stopped a study of two treatment strategies for patients with life-threatening heart arrhythmias: the implantable cardiac defibrillator versus antiarrhythmic drug treatment. NHLBI stopped the study early because deaths among the group of patients treated for arrhythmia (abnormal hearth rhythm) with the defibrillator decreased significantly.



The success of a NASA-developed implantable cardiac defibrillator was so significant a clinical trial comparing it to other treatment options was stopped early.

"The implantable cardiac defibrillator is like having an emergency room implanted in your chest," said Dr. Douglas Zipes, distinguished professor of medicine and chief of cardiology at Indiana University School of Medicine. Zipes was responsible for scientific conduct of the study.

NHLBI Director Dr. Claude Lenfant said more than 1,000 lives would be saved each year in the U.S. alone if the results of the study were applied to the population at risk. "This landmark study is the first large controlled study to

show that implantable cardiac defibrillators improve overall survival in patients with serious ventricular arrhythmias," Lenfant said. "We've known for some time that these devices stop arrhythmias and restore normal heart rhythm, but it has not been known — until now — whether they improve overall survival."

In the late 1970s through the 1980s, Goddard Space Flight Center was a major player in development of the first implantable defibrillator to win FDA approval. The Automatic Implantable Cardioverter Defibrillator or AICD™ was manufactured by Cardiac Pacemakers Inc., an Eli Lilly and Company subsidiary, and incorporates space-based miniaturized electronics to detect a broad range of spontaneous heart arrhythmias.

Other NASA technologies contributing to the defibrillator device include computer modeling and quality/control techniques. NASA also funded development of an AICD™ recording system and an independent design review of the system conducted by the Applied Physics Laboratory of Johns Hopkins University. This system was first implanted in a human on February 4, 1980.

The implantable cardioverter defibrillator's success in the treatment of life-threatening arrhythmias is another example of how NASA's Commercial Technology Network has contributed significantly to advances in biomedicine. ✱

For more information, contact Nona Minnifield at Goddard Space Flight Center. ☎ 301/286-5810, 📠 301/286-0301. Please mention you read about it in *Innovation*.

NASA Technology Helps Put Workers in Good Posture

A NEW NASA VIDEO ANALYSIS SOFTWARE tool will make working much more comfortable in space and on Earth.

Poor posture or protracted activities cause strain and fatigue for workers including busy astronauts in the seemingly unconstrained weightlessness of space.

The Posture Video Analysis Tool (PVAT) developed at Johnson Space Center (JSC) uses video from Space Shuttle flights to identify limiting posture and other human factors in the workplace that could be limiting. The software tool also provides data that recommends appropriate postures for certain tasks and safe durations for potentially harmful positions like when astronauts lay on their backs for several hours awaiting launch.

BioMetric Systems, Houston, Texas, has been granted an exclusive license to further develop PVAT for use by non-aerospace industries such as hospitals, physical rehabilitation facilities, insurance companies, sports medicine clinics, oil companies, manufacturers and the military.

BioMetric Systems is a woman-owned small business and first Native American company to license commercial technology with JSC. The international human factors engineering company will upgrade PVAT software systems for Apple Macintosh and IBM-compatible computers with the assistance of JSC's Technology Transfer and Commercialization Office.

NASA needed a low-cost, reliable method of collecting data on astronaut postures from non-scientific mission video. Traditional video analysis methods required predefined views from spacecraft cameras and specific reference points to classify working posture. Researchers use regular, nonscientific Shuttle videos to gather precise information about astronaut working postures and movements with PVAT.

PVAT uses an interactive Macintosh menu and button-driven software to collect information about a variety of postural parameters such as body orientation, body part movement, severe or mild flexation rating and task description. Analysis begins with a touch of a button once all entries are made. PVAT also includes a terminology library, animation illustrating selected posture classifications, data reduction summaries and report capabilities.

PVAT prepares astronauts for correctness of movement on Shuttle flights. It also identifies problems crews may have operating specific equipment to allow

for hardware or procedure modifications that reduce fatigue and stress.

"PVAT is unique because it provides a fast and simple way to collect and classify working postures, even from videos not recorded specifically for experimental analysis," said BioMetric Systems President Candace Caminati. "We are excited about PVAT's human factors design and analysis potential in a variety of commercial industries and plan to begin use immediately." ✱

For more information, contact Candace Caminati at Biometric Systems. ☎ 713/523-2803, ✉ biometrics@bigfoot.com Please mention you read about it in *Innovation*.

Composite Licensed for Pistons

NASA HAS GRANTED A GARDENA, CALIFORNIA company the first license to use a tough, space-age material to make high-performance pistons for internal combustion engines.

Other potential license applications could include oilless pistons for natural gas pumps; recreational vehicle engines for snowmobiles, motorcycles, hovercraft and jet-skis; and weight-critical applications like ultralight aircraft engines.

NASA granted Hitco Technologies exclusive rights to make, sell and use carbon-carbon pistons for high-performance automotive applications and co-exclusive rights for competition racing and small-to-large-bore diesel engines in the U.S. and certain foreign countries. The company intends to develop and manufacture the pistons at its Gardena factory.

Carbon-carbon pistons are significantly lighter than aluminum and steel pistons. In addition, their thermal expansion is significantly lower. Because of these attributes, they offer improved performance over their aluminum and steel counterparts. They also offer some potential for reducing emissions, if used in conjunction with carbon-carbon cylinder liners or carbon-carbon cylinder blocks. Pistons used in high-performance internal combustion engines usually are made of an aluminum alloy. The strength and stiffness of aluminum alloys decrease rapidly as temperatures rise above 350° Fahrenheit. Aluminum alloys melt at approximately 1,100° Fahrenheit while carbon-carbon does not melt and fully retains its room-temperature strength to temperatures well above 3000° Fahrenheit.

The material originally was developed in the 1960's for high-strength heat shields for strategic missile applications. It is widely used today for brakes in aircraft, clutches in Formula One and Indy race cars and for military and aerospace applications like the nose cap or wing leading edges of the Space Shuttle.

Langley Research Center researchers successfully tested prototype pistons in gasoline and diesel engines and have patented a number of concepts relating to carbon-carbon pistons for internal combustion engines.

"Carbon-carbon is the material of choice for the most demanding applications," said Burton Northam of Langley's Environmental Interactions Branch and a carbon-carbon piston researcher. Northam worked with Langley researchers Philip Ransone, Kevin Rivers and Philip Glaude in carrying on the pioneering work Langley's Allan Taylor began in the mid-1980s.

Langley's Technology Applications Group is seeking additional licensing partners for carbon-carbon piston technology and related technologies for cylinder liners, exhaust manifolds, engine valves, turbo-charger housings and rotary engine components. ✱

For more information, contact Rosa Webster at Langley Research Center. ☎ 757/864-3493, ✉ r.c.webster@larc.nasa.gov Please mention you read about it in *Innovation*.



Heat Resistant Material for High Performance Piston

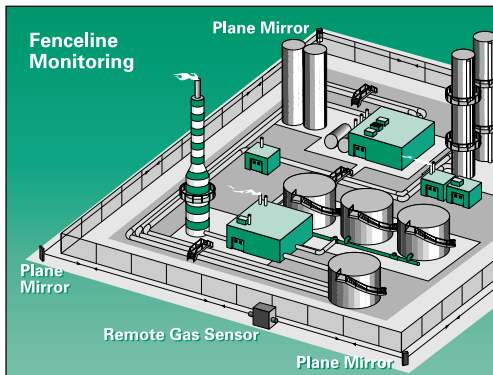
Air Quality Monitoring Technology Licensed

TECHNOLOGY ORIGINALLY DEVELOPED FOR monitoring atmospheric air quality now is being used to help U.S. industries reduce smokestack pollution.

A remote gas sensor with NASA technology could detect industrial pollution with a "fence" system that would allow the sensor to see around an area with help of mirrors.

NASA is working with MERCO Incorporated, Golden, Colorado, to jointly develop and commercialize the technology through a patent license agreement.

The Sensor Systems Branch at Langley Research Center will transfer its fast-response, non-mechanical, remote gas-sensing technology for monitoring gaseous pollutants emitted from petroleum refineries and



Artist Concept: Located at strategic points along the perimeter of an industrial site, the remote gas sensor can detect low concentrations of flammable gases—possibly preventing explosion.

chemical manufacturing facilities to MERCO.

The technology originally was developed to measure gases in the Earth's atmosphere from aircraft and satellite platforms, and its improved design makes it attractive for many Earth-based monitoring applications. Called the Gas Filter Correlation Radiometer, the

device possesses many distinct advantages over conventional gas sensors such as remote sensing capability, area source monitoring, higher reliability, faster response and more compact design.

The Mid-Continent Technology Transfer Center facilitated the agreement. MERCO anticipates rapid commercialization of the instrument. ✨

For more information, contact Rosemary Baize at Langley Research Center.
☎ 757/864-7717, 📠 757/864-8314, ✉ r.r.baize@larc.nasa.gov Please mention you read about it in *Innovation*.

NASA Joins Diabetes Fight

NASA'S OFFICE OF LIFE AND MICROGRAVITY Sciences and Applications and the Juvenile Diabetes Foundation signed a Space Act Agreement to research treating and monitoring diabetes and diabetes-related problems.

NASA and the Foundation will initiate joint research activities that will build on the strengths of the two organizations and support their respective goals. The agreement also has a technology transfer mechanism to make techniques and technologies developed by NASA researchers available to the diabetes research community. No funds are exchanged under this agreement.

NASA does not have a diabetes research program, but it is conducting research that would have an impact on the fight against diabetes. NASA sponsors protein crystal growth, three-dimensional tissue culturing and non-invasive diagnostic technologies research that can support the development of improved treatments.

NASA has grown human insulin crystals on two Space Shuttle missions to a quality that has not been achieved on Earth. X-ray diffraction crystallization has provided a more precise structural view of insulin mole-

cules which could lead to new insulin therapies through improved control over the effective rate of release of insulin into the blood stream.

One example of NASA's new non-invasive diagnostic technology is a portable laser light-scattering instrument to detect cataracts and other eye abnormalities in humans.

Rafat Ansari at Lewis Research Center developed the device which sends light waves through the eye and maps how they bounce off the internal structure of the eye, including the retina and cornea. Retinopathy, or retina disease, can be caused by or accelerated by diabetes, making the disease the leading cause of adult blindness in North America. Ansari's device, used on a regular basis during eye examinations, can help with early detection of diabetes-related optical problems, which in turn, could lead to better treatment at earlier stages of the disease. ✨

For more information, contact Michael Braukus at NASA Headquarters. ☎ 202/358-1979, 📠 202/358-4344 Please mention you read about it in *Innovation*.

KOOLATRON KEEPS FOOD HOT AND COLD

The NASA-inspired Koolatron keeps hot foods hot and cold foods cold.

The portable refrigeration unit, manufactured by Koolatron Division of Urus Industrial Corp., is replacing the traditional ice cooler with technology originally designed to provide cooling systems in the tight confines of space. The Koolatron is a refrigerator and a food warmer.

Space travel's tough demands forced scientists to find a more dependable and compact form of a space cooling system than traditional refrigeration coils and compressors. Research led them to discover a component called the thermo-electric module. Smaller than a matchbook, it delivers the cooling power of a 10-pound block of ice.

When connected to an electric source, current causes heat to move from one side to the other. The direction of the current, controlled in some models by the flick of a switch, determines whether the contents placed in the Koolatron is heated or cooled.

In the cool mode, the portable Koolatron reduces the outside temperature by 40° Fahrenheit. When used as a warmer, the Koolatron can warm food up to 125° Fahrenheit. The large model weighs only 12 pounds and can hold up to 40 12-oz. cans. The smaller model weighs seven pounds and holds six cans.

For more information, contact Arun Kulkarni at Koolatron. ☎ 519/756-3950. Please mention you read about it in *Innovation*.

ADVANCED TECHNOLOGIES

Hot Cities Turn to Cool Mother Nature

NASA RESEARCHERS ARE USING SPACE AGE technology to study how “urban forests” may allow cities to continuously grow while maintaining air quality and the environment and lower cooling costs during sweltering summer months.

Global Hydrology and Climate Center researchers at Marshall Space Flight Center are studying Atlanta to learn how rapid urbanization affects temperature and air quality to find out what can be done to lessen the impact.

Dr. Jeff Luvall and Dr. Dale Quattrochi are studying urban heat islands, bubble-like accumulations of hot air, that have developed as Atlanta has grown during the past 20 years. “Urban heat islands result when naturally vegetated surfaces are replaced with asphalt, concrete, rooftops and other man-made materials,” said Quattrochi.

They are studying the effect of tree cover on Atlanta’s temperature and air quality. Atlanta’s urban planners can use the findings to determine the benefits of developing and maintaining urban forests. Power requirements could be reduced with building plans that incorporate trees to shade roofs which reduce the heat load on houses and buildings.

Quattrochi said the artificial surfaces temperatures can be 20° to 40° higher than vegetated surfaces temperatures. “Materials, such as asphalt, store much of the sun’s energy and remain hot long after sunset. This produces a dome over the city of temperatures 5° to 10° higher than air temperatures over adjacent rural areas,” Quattrochi said.

“The more a city grows—replacing trees and grass with buildings and roads—the warmer it becomes, increasing peak power demands. To meet these demands, power plants must utilize fossil fuels

to a greater extent, which ultimately have a negative impact on air quality,” said Luvall.

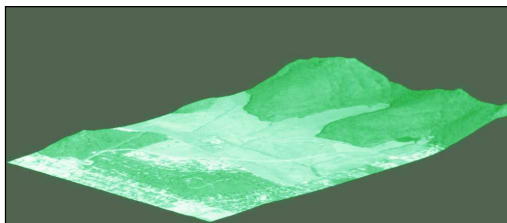
In findings from similar studies, the two researchers found that city parks and other urban areas with trees and grass were cooler than parking lots and areas with a high concentration of buildings. “These ‘green areas’ are cooler because they dissipate solar energy by absorbing surrounding heat and using it to evaporate water from leaves, thereby cooling the air,” said Luvall. Urban forests also help cool cities by shading surfaces like asphalt, roofs and concrete parking lots, preventing the initial heating and heat storage.

Atlanta’s hot spots were determined by a Lear Jet equipped with thermal imaging equipment which flew over the metropolitan area May 11th and 12th taking heat images at mid-day at peak heat and again 12 hours later when surfaces began to cool. ✱

For more information, contact Dr. Dale Quattrochi at Marshall Space Flight Center. ☎ 205/922-5887, ✉ dale.quattrochi@msfc.nasa.gov Please mention you read about it in *Innovation*.



Organized planning of “urban forests” in cities like Atlanta may counteract temperature rises caused by over-development.



Thermal views of Atlanta are helping researchers determine the effects of urbanization on a city’s climate.

Weather-piercing Camera Reduces Delays

A WEATHER-PIERCING CAMERA COULD ELIMINATE air traffic delays due to poor visibility if it looks as good in the air as it does on the ground.

NASA’s Langley Research Center and Ames Research Center, the U. S. Air Force Flight Test Center and an industry and government consortium led by TRW Space & Electronics Group, Redondo Beach, California, will demonstrate in flight a weather-piercing camera that has allowed researchers to see through fog, smoke and clouds.

ADVANCED TECHNOLOGIES

The camera “sees” in the millimeter wave portion of the electromagnetic spectrum, which is invisible to the human eye. It produces video images from which a pilot discerns features like runways, obstacles and the horizon.

These features are sufficient to safely land, take off, roll out and taxi at any airline terminal in the country. The passive sensor camera emits no signals in an airport environment, so multiple equipped aircraft may operate simultaneously on the ground without risk of interference.

“This sensor program directly supports NASA’s new goal to safely triple capacity at our nation’s commercial airports within the next ten years—regardless of fog, clouds, smoke, and dust that can limit pilot visibility,” said Tom Campbell, head of Langley’s Electromagnetic Research Branch.

The Department of Defense awarded the TRW-led Passive Millimeter Wave Camera Consortium a \$15 million cost-sharing contract in 1994 to adapt this technology to an airborne camera for military and civilian users. Langley, the government’s principal representative, is funding the flight tests.

Langley also is performing lab tests to determine which materials are good candidates for the protective nose, dual-frequency band, radome that will

house the camera on the flight test aircraft, a one-of-a-kind Air Force C-135. The consortium’s radome design team will get data about optimum material thicknesses and rain erosion and static build-up protection from these tests. Then a new dual-frequency band radome will be fabricated by Composite Optics, Inc. and installed on the C-135 aircraft.

*Weather piercing camera
reduces delays.*



ROBOTIC BRAIN SURGEON

NASA unveiled its revolutionary robotic “brain surgeon” that learns the brain’s physical characteristics at the Medical Design and Manufacturing Show in New York in June.

The device could help surgeons avoid dangerous hemorrhaging during delicate brain operations and lead to “smart” surgical tools that will increase safety, accuracy and efficiency of neurosurgical, exploratory and breast and prostate cancer surgical procedures.

The robot gives surgeons finer control of surgical instruments during delicate brain operations. It is still under development though human trials are expected within one year.

“Potentially, the simple robot will be able to ‘feel’ brain structures better than any human surgeon, making slow, very precise movements during an operation,” said Principal Investigator Dr. Robert W. Mah of Ames Research Center.

The robotic surgeon “learns” the characteristics of different kinds of tissues by using neural net software, the same technology that focuses camcorders.

Ames is developing robotic surgery to deal with medical emergencies that may occur during long-duration human space flights.

NASA invests more than \$5 billion in technology development annually, said Michael Weingarten, NASA manager for business development. “It makes sense to bring that cutting-edge technology back to U.S. taxpayers when such a huge investment is being made,” Weingarten said. “Companies can work with NASA or with licensed NASA technicians in efforts that will lead to new company products. We can explore the best way to partner depending on each client’s needs.”

For more information about the robotic brain surgeon, contact the National Technology Transfer Center. ☎ 800/678-6882. Please mention you read about it in *Innovation*.

The compact camera will generate video images of the forward scene in low-visibility conditions. These images will be displayed on a see-through heads-up display suspended between the pilot and the windscreen.

"Based on the images we have acquired under low-visibility conditions, and the quality of the receivers we have developed, we are confident that we are bringing to the aviation market a needed product that can be manufactured efficiently and at low cost," said Dr. Steven Fornaca, the consortium's program manager at TRW. ✱

For more information, contact Tom Campbell at Langley Research Center.

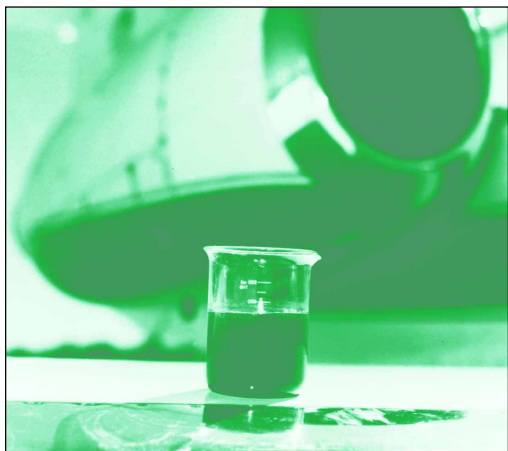
☎ 757/864-1772, 📠 757/864-7975, ✉ t.g.campbell@larc.nasa.gov

Please mention you read about it in *Innovation*.

"Food Grade" Anti-icing Fluid Reduces Auto Rust Too

ANASA-DEVELOPED FLUID WILL MAKE FLYING safer without introducing dangerous chemicals into the environment. It also may reduce rust and corrosion on cars.

Ice buildup on airplanes is eliminated with Ames Research Center's non-toxic fluid, which is so environmentally safe it has been referred to as "food grade" because its ingredients have been approved by the Food



In keeping with one of NASA's major goals, the new fluid can also increase flight safety. The beaker of the fluid is on the wing of a Lear Jet.

and Drug Administration for use in food. Leonard Haslim, John Zuk and Robert Lockyer invented the fluid, which contains propylene glycol, a food grade substance.

"The food grade anti-icing fluid works as well as, or better than available fluids, and it is the only one that is non-toxic and totally biodegradable," said Haslim.

"When you look at the high costs of rust and other salt damage to cars, bridges, roads, and the environment, it is obvious that using this new anti-icing fluid can save a lot of money," Haslim said. "You can even spray the stuff on your windshield the night before you go to work, and the next morning, the wiper blades will easily push the ice completely off the glass."

About a half a billion gallons of aircraft de-icing fluid are used annually worldwide. The anti-icing fluid grabs onto an airplane's surface better than current fluids when a plane is at rest. "Our new fluid produces a long-lasting barrier to ice build-up. But when the plane takes off, the fluid suddenly gets thinner, and it blows away so the wings are clean and have plenty of lift force as the plane rises," said Lockyer.

"I compare the green-colored fluid to lime sherbet when it is on the wing and limeade when the plane is moving," said Haslim.

The new fluid is neutral, neither an acid nor a base, and is non-conductive. It appears to be harmless to aircraft, pavement, bridges and vehicles, Haslim said. "It should not hurt plants."

The Air Force's Wright Laboratory sponsored development and test work on the new fluid. The Army Corps of Engineers' Cold Regions Research and Engineering Laboratory is testing the fluid for use on highways, bridges, railways, canals and transportation and communications structures. ✱



Inventors Leonard Haslim and John Zuk display NASA Ames "Food Grade".

For more information about the anti-icing fluid, contact Dr. Leonard Haslim at Ames Research Center. ☎ 415/604-6575, 📠 415/604-6996 or the National Technology Transfer Center ☎ 800/678-6882. Please mention you read about it in *Innovation*.

AEROSPACE TECHNOLOGY DEVELOPMENT

New Spacecraft Tests Begin

NASA BEGAN UNPILOTED TEST FLIGHTS IN July of an atmospheric test vehicle that could become the first new piloted spacecraft to and from orbit in more than 20 years.

The X-38 atmospheric test vehicle someday might be delivered to the International Space Station via the Space Shuttle as an emergency lifeboat for Space Station crew. Researchers are trying to develop an easily modifiable design so the X-38 can be adapted to other uses such as a possible joint U.S. and European human spacecraft.

The X-38 was shipped from Johnson Space Center to Dryden Flight Research Center for the tests. The atmospheric test vehicle, Vehicle 131, is the first of three sub-scale vehicles planned for testing. All three vehicles were largely built at Johnson.

The X-38 is being developed with an unprecedented eye toward efficiency. As much as 80 percent of its design uses readily available equipment and technology. The design uses a lifting body concept originally developed by the Air Force's X-24A project in the mid-1970s. Following the jettison of a deorbit engine module, the X-38 would glide from orbit unpowered like the Space Shuttle and use a steerable parafoil parachute for its final descent to landing.

A Russian Soyuz spacecraft will be attached to the station as a crew return vehicle in the early years of the International Space Station. However, a return vehicle like the X-38, accommodating up to six passengers, will be needed as the size of the station crew increases.

"Captive carry" flights commenced the unpiloted flight testing at Dryden. The vehicle remains attached to a NASA B-52 aircraft during "captive carry" flights. The first free-flight drop test in which the vehicle is

released at an altitude of 25,000 feet, will be in late August. Similar free-flight drop testing will continue at Dryden periodically through late 1999. An unpiloted space flight test is scheduled for launch aboard a Space Shuttle in spring 2000. Johnson will also build the X-38 space flight test vehicle.

"Beginning full-scale flight tests is a big milestone for us," said X-38 Project Manager John Muratore. "No one has ever done anything like this before—deploying a parafoil from a lifting body and flying a lifting body with an all-electric flight control system—and there are unknowns. We expect surprises, but we have done a lot of work to minimize the unknowns, and we are confident this vehicle can perform well." ✨

For more information, contact Audrey Schwartz at Johnson Space Center. ✉ 281/483-3276, ✉ audrey.schwartz1@jsc.nasa.gov Please mention you read about it in *Innovation*.

Upgraded ER-2 Flies Even Higher

NASA RESEARCHERS FROM LANGLEY RESEARCH Center used an upgraded ER-2 aircraft based at Ames Research Center to measure naturally-occurring radiation from cosmic and solar rays at altitudes between 52,000 and 70,000 feet.

An ER-2, complete with a full array of science instrument packages, also recently conducted its first operational mission at 70,000 feet altitude, a key atmospheric research region. The aircraft flew over the North Pole for POLARIS (Photochemistry of Ozone Loss in the Arctic Region In Summer).

The data gathered by the Langley Researchers will be used to characterize the radiation environment for the aircrew and frequent-flying public on a future High-Speed Civil Transport. The High-Speed Civil Transport, a conceptual supersonic airliner, would carry 300 passengers at 2.4 times the speed of sound, at altitudes of up to 68,000 feet.

The High Speed Research Program funded the radiation measurement project. "The primary thrust (of the study) is to characterize the atmospheric radiation and to define dose levels at high altitude flight. A secondary thrust is to develop and validate dosimetric techniques and monitoring devices for protection of the aircrew who work many hours at

NASA's first X-38 advanced technology demonstrator for the proposed crew return vehicle is delivered to Dryden Flight Research Center.



CLOUDY, COLD ON MARS

Astronomers using the Hubble Space Telescope provide updated planetary weather reports to help plan NASA's two mid-year missions to Mars.

Hubble images taken barely three weeks apart show that the Mars Pathfinder that landed on July 4 and the Mars Global Surveyor that will land September will experience considerably cloudier and colder conditions than seen by Viking, the last U.S. spacecraft to land on Mars 21 years ago.

"Understanding the state of the atmosphere prior to landing is important," said Dr. Matthew Golombek, Pathfinder project scientist at NASA's Jet Propulsion Laboratory. Hubble images of Mars are helping us to adjust our flight path for landing and effectively plan surface operations," said Golombek.

NASA's Mars Global Surveyor will skim across the upper martian atmosphere to slow down by friction and enter orbit around the red planet. Atmospheric density is a key factor in precisely executing this complex and delicate aerobraking maneuver. Hubble is ideal for tracking dust storms which could threaten Surveyor by drastically changing the planet's air density.

Hubble's "weather satellite" view is complementary to close-up views provided by Pathfinder and Surveyor.

For more information, contact Donald Savage at NASA Headquarters. ✉ 202/358-1547. Please mention you read about it in *Innovation*.

operate approximately 2,500 feet higher than previously possible due to lower fuel requirements and lighter aircraft weight. This increased altitude capability permits extension of in-place measurements for validating and upgrading existing models of the upper atmosphere. ✱

For more information, contact Jim Barrilleaux at Ames Research Center. ✉ 415-604-4724, ✉ barrilleaux@mail.arc.nasa.gov Please mention you read about it in *Innovation*.

Tests Could Cut Aircraft Fuel Costs

NASA RESEARCHERS HAVE BEGUN TESTS they hope will lead to improved commercial aircraft efficiency and \$140 million annual fuel cost savings by minimizing aerodynamic drag.

Drag is the aerodynamic force from air pressure and friction that resists passage of an aircraft as it flies through the air.

Adaptive Performance Optimization experiment tests will obtain data on putting an aircraft's control surfaces in the best position to reduce drag. Dryden Flight Research Center (DFRC) began tests in May using a modified Lockheed L-1011 TriStar operated by Orbital Sciences Corp. of Dulles, Virginia.

Langley Research Center is sponsoring the tests as part of its Advanced Subsonic Transport Aircraft Research Program.

"A drag reduction of only one percent translates into an equivalent saving in fuel usage and fuel costs, a major factor in airline operations when you improve the efficiency of transport aircraft by minimizing aerodynamic drag," said DFRC's Glenn Gilyard, the experiment's principal investigator and flight-test director. Project officials hope for drag reductions of up to three percent.

The research team will fly the aircraft three or four times each year over the next two or three years. Most of the tests will be flown at speeds of about Mach 0.83 and at altitudes of 30,000 to 40,000 feet.

This Lockheed L-1011 TriStar aircraft is the subject of new flight research developed to improve the efficiency of large transport aircraft.



cruise altitudes," said Donald Maiden, Atmospheric Ionizing Radiation project manager.

Also collaborating on this project are Johnson Space Center, Department of Energy's Environmental Measurements Laboratory, Canadian Defense Research Establishment and Royal Military College, German Aerospace Research Establishment, the United Kingdom's National Radiation Protection Board, and Boeing Company.

The POLARIS mission seeks to understand the fundamental chemistry that dominates the naturally occurring seasonal reduction of ozone over the pole in the course of the Arctic summer.

The ER-2, a civilian version of the U-2 aerial reconnaissance plane, is sponsored by the Mission to Planet Earth Program. POLARIS project scientists are interested in many of the chemical reactions that occur at 75,000 feet. Now, a fully-loaded ER-2 can



The NASA/McDonnell Douglas X-36 remotely-piloted tailless aircraft takes off for the first time in May.

Gilyard said all aircraft are designed to operate most efficiently at a single point in their flight profile. Unfortunately, they often do not fly at that design point, and therefore, fly at reduced efficiency, he said.

“The experiment is designed to improve aircraft performance during a given flight condition, based on real-time, in-flight measurements and analysis,” Gilyard said.

An engineering team designed a software program for the aircraft’s research computer that reduces the aircraft’s drag by changing the positions of its aerodynamic control surfaces. The program incorporates airspeed, altitude, engine measurements, and other data to make instant adjustments to the aircraft’s control surface positions for greatest aircraft efficiency at each flight profile point.

Engineers also developed flight-research systems that will record test data and permit on-board flight test engineers to make decisions and analyze research data in-flight.

“We are trying to achieve savings based on the difference between what the manufacturer designed the airplane to be and what the airplane actually is,” said Gilyard. “The bottom line is how much fuel goes into that airplane over the course of a year.”

Potential fuel cost savings could be \$130,000–\$150,000 per year per aircraft depending on its type. 🌟

For more information, contact Fred Brown at Dryden Flight Research Center.

☎ 805/258-2663, ✉ fred.brown@dfrc.nasa.gov Please mention you read about it in *Innovation*.

First Flight for Tailless Aircraft

WHAT COULD BE FIGHTER AIRCRAFT OF THE future had an “outstanding” first test-flight.

The X-36, a NASA/McDonnell Douglas remotely piloted, tailless aircraft, took off from Dryden Flight Research Center and flew for five minutes at an altitude of approximately 4,900 feet. More test flights are scheduled.

“We thought the flight was outstanding. We are beginning to show what the fighter aircraft of the future will look like,” said X-36 Program Manager Rod Bailey. When we saw this airplane lift off, we saw the shape of airplanes to come.”

Ames Research Center leads the X-36 program and is responsible for continued development of necessary critical technologies for future tailless, stealthy fighter aircraft. Lack of vertical tails greatly enhances the airplane’s stealthy characteristics and holds promise for greater agility than available in existing military fighter aircraft.

McDonnell Douglas has built two 28-percent-scale X-36s, remotely piloted jets that fly without traditional vertical and horizontal aircraft tails. Each aircraft measures 18 feet long, three feet high, has a 10-foot wing span, weighs 1,250 pounds and is powered by a Williams Research F112 turbofan engine with 700 pounds of thrust.

A pilot in a ground station cockpit with a heads-up display remotely controls the X-36. The pilot-in-the-loop approach eliminates need for expensive and complex autonomous flight control systems. The design reduces aircraft weight and drag and explores new flight control technologies. The aircraft use split ailerons to provide yaw control and normal raising and lowering for roll control and incorporates a thrust vectoring system.

“The flight control system functioned flawlessly and we look forward to subsequent flights to demonstrate the full range of maneuverability of the aircraft,” said X-36 Project Manager Mark Sumich.

“We knew within five to ten seconds into the flight that we had a good flying airplane,” said McDonnell Douglas X-36 Program Manager Gary Jennings. “Flying in a simulator is one thing, but until you actually fly the airplane, you do not really know how it will handle. We found out that it handled extremely well.”

The \$20 million X-36 project is funded by a roughly 50/50 cost-sharing arrangement between NASA and McDonnell Douglas.

“The first flight went very well. It was just textbook perfect,” said X-36 Project Pilot Larry Walker. “It was a nice takeoff and the handling was great. I knew instantly that it was a nice flying airplane. I see no obstacles in the future for this type of technology.” 🌟

For more information, contact Fred Brown at Dryden Flight Research Center.

☎ 805/258-3449, ✉ fred.brown@dfrc.nasa.gov Please mention you read about it in *Innovation*.

SMALL BUSINESS/SBIR

SBIR Company "Flies" with Contract

ACCURATE AUTOMATION CORPORATION (AAC) of Chattanooga, Tennessee, is a member of the team selected by NASA to design and construct four Hyper-X research vehicles under a \$33.4 million performance-based contract.

The vehicles are to be tested at Mach 5, 7 and 10 at 100,000 feet altitude to validate airframe-integrated, dual-mode scramjet performance in flight. The Hyper-X program, conducted by Langley Research Center and Dryden Flight Research Center is projected to cost \$166 million.

The absence of a test platform for scramjet-powered (supersonic-combustion ramjet) aircraft in flight has slowed development of hypersonic aircraft, an air-breathing economical alternative to rocket-propelled vehicles. Validity of scramjets testing to date has not been confirmed because it has occurred on the ground under simulated flight conditions. NASA has been working for several years to determine the appropriate air-borne testbed needed to verify laboratory results.

The 12-foot long vehicles will be air-launched from a B-52 and boosted to hypersonic speeds with booster rockets. The first flight, at Mach 7, is scheduled for 1999 with about one flight each 10 months through 2001.

Developing an experimental aircraft in two years is unprecedented. "Most impressively, these flights will begin less than two years from now. Under old ways of doing business it might have taken ten years to reach flight tests," said NASA Administrator Daniel S. Goldin.



AAC will be responsible for the sensor suite and telemetry system for the Hyper-X aircraft. This \$3.7 million portion of the program is very critical as each aircraft will collect scramjet data for only about five seconds. Fast and accurate data transmission and reception is essential for mission success since more than 300 telemetry parameters, including those needed for flight control, will be collected during the approximately 5- to 10-second data collection period.

AAC's expertise in sensor technology is a result of ongoing NASA and Air Force SBIR programs. The first is LoFLYTE, a joint program to develop a neural network flight testbed for subsonic speeds. The second is a NASA SBIR program to develop an air-data sensor subsystem that uses pressure-sensitive "smart skins" and neural networks to compute air data. This eliminates the need for pilot tubes, reducing the aircraft's drag and



radar signatures. The third is a series of SBIR contracts involving sensor fusion, the combination and analysis of sensor data from multiple sources through the use of neural networks, to increase clarity and sensitivity while reducing errors in data received from single sensors.

For more information, contact Bob Pegg at Langley Research Center.

 757/864-3760,  757/864-8545. Please mention you read about it in *Innovation*.

Accurate Automation Corporation will help NASA design and construct four Hyper-X vehicles. AAC's expertise with sensor technology was developed via SBIR projects like LoFlyte.

TWO NASA TECHNOLOGIES IN HALL OF FAME

NASA's Advanced Communication Technology Satellite (ACTS) and new charge coupled devices recently were inducted into the U.S. Space Foundation's Space Technology Hall of Fame.

Lewis Research Center, NASA Headquarters and various contractors developed and produced the Advanced Communication Technology Satellite (ACTS), recognized for its space technology contributions and spinoff applications. Lewis has implemented a partnership program in which ACTS technologies have been applied to the fields of telemedicine, long-distance education, telecommunications and the banking and petroleum industries.

Goddard Space Flight Center and Scientific Imaging Technologies also were recognized for new charge coupled devices. These devices, silicon chips that convert light directly into electronic or digital images, were developed for the stringent requirements of the Hubble Space Telescope. Medical applications of this technology has led to the StereoGuide Breast Biopsy System. The system, developed by the LORAD subsidiary of Trex Medical Corp., is minimally invasive and exposes a patient to half the radiation of conventional x-rays, saving time, pain and scarring while reducing health care costs.

For more information, contact Beth Schmid at NASA Headquarters.

 202/358-1760. Please mention you read about it in *Innovation*.

More Precise Ocean Study with Innovative Tools

A FAMILY OF SUBMERSIBLE OPTICAL INSTRUMENTS used around the world to study the productivity of the world's oceans were developed by Biospherical Instruments, Inc. of San Diego, California, with support of two NASA Small Business Innovation Research contracts managed by Jet Propulsion Laboratory (JPL).

The natural fluorometer measures the concentration of microscopic marine plants or phytoplankton, the primary food source for sea animals. The self-contained, reflectance spectral radiometer calibrates satellite ocean color data for measuring ocean phytoplankton biomass.

Chlorophyll in phytoplankton emits a natural fluorescence during photosynthesis. The natural fluorometer estimates phytoplankton's growth using intensity of fluorescence when phytoplankton is exposed to sunlight. The portable natural fluorometer measures depth, sunlight, temperature and pressure of a particular location on site and is cheaper than earlier methods of measuring photosynthetic productivity which required sample removal for laboratory testing.

Biospherical Instruments also has developed a natural fluorometer that can be left unattended at a specific location for a long time. This instrument helps measure the environmental impact of coastal installations, including offshore platforms, coastal power plants and recreational harbors. The Los Angeles Department of Water and Power also has used the instrument to monitor plankton concentrations in its municipal reservoir, reducing costs and improving water quality with more accurate administration of drinking water treatment.

Biospherical Instruments developed the reflectance spectral radiometer to support NASA's SeaWiFS Project. Subtle changes in ocean color signify various types and quantities of phytoplankton. Satellites collect this color data over wide areas of ocean. Data collection from a submersible radiometer and other instruments, referred to as ground truthing, helps calibrate the satellite observations.

Phytoplankton growth is an important factor in the exchange of gases between the atmosphere and the world's oceans. For example, volume of marine life is important to the atmosphere's carbon dioxide content. Carbon dioxide factors into the "greenhouse effect" or

global warming attributed to increases in concentration of this gas in the atmosphere.

University of Southern California, JPL, Lamont-Doherty Geophysical Observatory and the University of Hawaii researchers are among those from many countries who have used these instruments to study oceans and inland bodies of water. This type of research is expected to increase because of the growing recognition of the importance of oceans in determining weather patterns and atmospheric composition. ✱

For more information about this technology, contact Patricia McGuire at Jet Propulsion Laboratory. ☎ 818/354-1258, ✉ Patricia.A.McGuire@jpl.nasa.gov Please mention you read about it in *Innovation*.

ASTRONAUTS "AT HEART" OF STUDY

NASA and The Cleveland Clinic will study ways to monitor the effects of long-term space flight on the human heart and develop conditioning regimens to counteract those effects in preparation for the International Space Station.

NASA recently announced a two-year, \$4 million cooperative agreement to support the research and development of a digital echocardiography lab at The Cleveland Clinic.

"We know that astronauts who spend longer periods of time in space experience cardiovascular 'de-conditioning.' They return to Earth weakened and with low blood pressure, less blood volume, and a loss of tone to their blood vessels," said Dr. James D. Thomas, director of Cardiovascular Imaging at The Cleveland Clinic. "However, we don't know why this happens and if the heart itself is weakened."

The joint expertise of The Cleveland Clinic and Johnson Space Center will support human space endeavors, improve the quality of life on Earth through the enhancement of the growing field of telemedicine and add to heart function knowledge.

Digital echocardiographic equipment will be on the Space Station when it is operational. Echocardiography is more practical for life in space because it requires less power, is non-invasive, is small and versatile and is not magnetic or radioactive.

For more information, contact Rob Whitehouse at The Cleveland Clinic. ☎ 216/444-8927. Please mention you read about it in *Innovation*.

MOVING FORWARD

NASA Incubator Lifts Off

NASA IS PARTNERING WITH THE OHIO Department of Development and the City of Cleveland's corporate community to create a world-class environment for entrepreneurship with a modest investment of public dollars.

Lewis Research Center, Great Lakes Industrial Technology Center (GLITeC), Enterprise Development Inc. and the State of Ohio are developing the Lewis Incubator for Technology (LIFT) to commercialize NASA-developed technologies.

LIFT enables entrepreneurs, start-up companies and early-stage companies to gain comprehensive business, financial and marketing assistance while residing in a state-of-the-art laboratory environment in Cleveland.

"NASA has an obligation to maximize the return on the American taxpayer's investment in the space program. One of the most effective ways to do this is through the transfer of NASA's technology to business," said NASA Administrator Daniel Goldin. "An incubator, like the one initiated at NASA Lewis, is an effective way to generate new businesses and explore innovative concepts. LIFT builds on the proven strengths and capabilities of several entities in the Cleveland region and State of Ohio to create a world-class environment for entrepreneurship with a modest investment of public funds."

Enterprise Development Inc. manages LIFT under a cooperative agreement with Lewis. LIFT is jointly funded by NASA and the State of Ohio. LIFT tenants have access to laboratory and office space, machine and graphics shops and conference and library facilities at BP's Cleveland Research Center.

An important component of LIFT's success will be identifying viable technology on which fledgling companies can base their business. The LIFT management team developed a technology evaluation process to assess Lewis technologies appropriate for emerging technology companies. The evaluations are conducted by GLITeC, NASA's Midwest Regional Technology Transfer Center, and identify potential commercial markets for technology, assess general conditions of markets and compare the technology to competing technologies. This information is used to identify viable technology candidates for LIFT tenants and decide whether a patent application should be filed or whether existing patents should be maintained.



Rob Usher of GLITeC, kneeling, Kim Veris of Lewis Research Center and Wayne Zeman, Enterprise Development Inc. watch Lewis Researcher Mark Bethea demonstrate his stereo imaging velocimetry technology, one of the first assessed for the Lewis Incubator for Technology.

"This is an exceptional public and private sector partnership that will provide an outstanding environment for the creation of new products, jobs, and opportunities for economic growth in Northeast Ohio," said Lewis Director Donald Campbell. ✱

For more information, contact Rob Usher at GLITeC. ☎ 216/ 734-1796, usherr@battelle.org Please mention you read about it in *Innovation*.

FLC PRESENTS TECH TRANSFER AWARDS FOR EXCELLENCE

The Federal Laboratory Consortium presented several NASA laboratory personnel Awards for Excellence in Technology Transfer.

The FLC recognizes federal laboratory personnel for their unique creativity and initiative in conveying innovations from their facilities to industry and local government.

The NASA winners were Christopher L. Rumsey and Robert T. Bledron, Billy Upchurch, David Schryer, Patricia Davis, Kenneth Brown and Erik Kielin, all of Langley Research Center.

Rumsey and Bledron were recognized for their development and transfer of Computer CFL3D for the analysis of viscous flow over complex configuration.

Upchurch, Schryer, Davis, Brown and Kielin were recognized for their development and transfer of low-temperature oxidation catalysts.

TECHNOLOGY OPPORTUNITY SHOWCASE

Moving Forward



Technology Opportunity Showcase highlights some unique technologies that NASA has developed and which we believe have strong potential for commercial application. While the descriptions provided here are brief, they should provide enough information to communicate the potential applications of the technology. For more detailed information, contact the person listed. Please mention that you read about it in *Innovation*.

Mass Density Sensor

Langley Research Center is seeking partners to license and cooperatively develop a commercial product using its Mass Density Sensor technology. This technology is a safe, mechanically robust, non-intrusive, low-cost method for determining the resin content of textile materials during manufacturing. The Mass Density Sensor measures mass density, spin finish, resin applied to tows and coating of synthetic yarns like nylon and polyester and optical fibers. The direct use of mechanical vibration and an optical technique for sensing vibrations of the tow is novel to this sensor. The system uses natural mechanical resonance in a moving resin-impregnated yarn or tow to determine the amount of resin that has been applied. The tow is held under tension. Vibration is then induced and sensed at the center of the proposed span by an optical sensor. Finally, the sensor's output is amplified and analyzed. Well-known relationships from physics predict that the natural frequencies of the vibration are inversely proportional to the square root of the desired mass per unit length.

For more information, contact Greg Manuel at Langley Research Center.

📞 757/864-3864, 📠 757/864-8314, ✉ g.s.manuel@larc.nasa.gov

Cares Software Assesses Integrity

Lewis Research Center has developed a software series that will provide an innovative and low-cost method for assessing the integrity and reliability of structural ceramic and brittle material components. The Ceramics Analysis and Reliability Evaluation of Structures (CARES) software package will make it possible to safely determine the life-span and durability of existing brittle-material and ceramic structures while determining the best use of high-value-added materials in high-stress structures. The software combines multi-disciplinary research, including fracture analysis, probabilistic modeling, model validation and brittle structure design. CARES can provide accurate predictions of the product's capabilities before it is manufactured. Input for this software includes material data from simple experiments and stress and temperature distributions obtained from finite element analysis. The software could have numerous applications for testing material in the aerospace, automotive, propulsion and power, bioengineering, and glass industries.

For more information, contact Lesley A. Janosik at Lewis Research Center

📞 216/433-5160, 📠 216/433-8300, ✉ lesley.a.janosik@lerc.nasa.gov

Composite Materials Manufacturing

U.S. industry is invited to use innovative and economical manufacturing techniques that produced composite materials for NASA's Reusable Space Vehicle (RSV) at Marshall Space Flight Center (MSFC). Computer-aided drawings and specialized machinery, such as MSFC's automated fabrication systems, work precisely with many different types of materials including glass, Kevlar and carbon/graphite fibers to produce strong, durable and inexpensive materials. Composite materials may be used to increase a product's strength without adding to its overall weight, making it ideal for products that must conform to specific weight, strength or durability requirements. Although many of MSFC's machines produce aerospace materials, they can be used to produce improved consumer products through slight engineering adjustments.

For more information, contact the Technology Transfer Office at the Marshall Space Flight Center. 📞 800/USA-NASA.

Next Generation Molded Magnets

An improved, low-cost method of manufacturing molded-magnets will use metallic particles. Langley Research Center developed LaRC-SI, a high performance polymer binder. Magnets produced by this method molded to fit other components, are resistant to thermal shock, exhibit high rupture strength and magnetic anisotropy and experience lower high frequency and eddy current loss than conventional magnets. The environmentally durable process, used for both hard and soft materials, enables tailoring of magnetic properties to a specific application. Waste materials produced from manufacturing are recyclable. LaRC-SI is the binder of choice in this process as it exhibits high-adhesive strength and dielectric properties, is durable and has excellent solvent resistance properties. The biocompatible polymer can be continuously used from cryogenic temperatures to 200 degrees Celsius. This technology has potential for use in transformers, motors; aerospace, agricultural and automotive ignition coils; evaluation and testing equipment and medical devices. 🌟

For more information, contact Gaudy M. Bezos-O'Connor at Langley Research Center. 📞 757/864-5083, 📠 757/864-8314, ✉ g.m.bezos-o'connor@larc.nasa.gov

Please mention you read about it in *Innovation*.



NASA Field Centers

Ames Research Center

Selected technological strengths are Information Technologies, Aerospace Systems, Autonomous Systems for Space Flight, Computational Fluid Dynamics and Aviation Operations.

Bruce Webbon

Ames Research Center
Moffett Field, California 94035-1000
650/604-6646
bwebbon@mail.arc.nasa.gov

Dryden Flight Research Center

Selected technological strengths are Aerodynamics, Aeronautics Flight Testing, Aeropropulsion, Flight Systems, Thermal Testing and Integrated Systems Test and Validation.

Eugene (Lee) Duke

Dryden Flight Research Center
Edwards, California 93523-0273
805/258-3802
duke@louie.drfc.nasa.gov

Goddard Space Flight Center

Selected technological strengths are Earth and Planetary Science Missions, LIDAR, Cryogenic Systems, Tracking, Telemetry, Command, Optics and Sensors/Detectors.

George Alcorn

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Greenbelt, Maryland 20771
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Jet Propulsion Laboratory

Selected technological strengths are Near/Deep-Space Mission Engineering, Microspacecraft, Space Communications, Information Systems, Remote Sensing and Robotics.

Merle McKenzie

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Johnson Space Center

Selected technological strengths are Artificial Intelligence and Human Computer Interface, Life Sciences, Human Space Flight Operations, Avionics, Sensors and Communications.

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Kennedy Space Center

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Langley Research Center

Selected technological strengths are Aerodynamics, Flight Systems, Materials, Structures, Sensors, Measurements and Information Sciences.

Joe Heyman

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Lewis Research Center

Selected technological strengths are Aeropropulsion, Communications, Energy Technology and High Temperature Materials Research, Microgravity Science and Technology and Instrumentation Control Systems.

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John.M.Hairston@lerc.nasa.gov

Marshall Space Flight Center

Selected technological strengths are Materials, Manufacturing, Non-destructive Evaluation, Biotechnology, Space Propulsion, Controls and Dynamics, Structures and Microgravity Processing.

Sally Little

Marshall Space Flight Center
Huntsville, Alabama 35812
205/544-4266
sally.little@msfc.nasa.gov

Stennis Space Center

Selected technological strengths are Propulsion Systems, Test/Monitoring, Remote Sensing and Nonintrusive Instrumentation.

Kirk Sharp

Stennis Space Center
Stennis Space Center, Mississippi
39529-6000
601/688-1929
kirk.sharp@ssc.nasa.gov

NASA's Business Facilitators

NASA has established several organizations whose objectives are to establish joint sponsored research agreements and incubate small start-up companies with significant business promise.

Joseph C. Boeddeker

Ames Technology Commercialization Center
San Jose, CA
408/260-6566

Dan Morrison

Mississippi Enterprise for Technology

Stennis Space Center, MS
601/688-3144

Wayne P. Zeman

Lewis Incubator for Technology
Cleveland, OH
216/586-3888

Maria Clark

Florida/NASA Business Incubation Center
Titusville, FL
407/383-5200

Small Business Programs

Carl Ray
NASA Headquarters
Small Business Technology Transfer (SBIR/STTR)
202/358-4652
cray@hq.nasa.gov

Paul Mexcur
Goddard Space Flight Center
Small Business Innovation Research Program (SBIR/STTR)
301/286-8888
paul.mexcur@pop700.gsfc.nasa.gov

NASA-Sponsored Commercial Technology Organizations

These organizations were established to provide rapid access to NASA and other federal R&D and foster collaboration between public and private sector organizations. They also can direct you to the appropriate point of contact within the Federal Laboratory Consortium. To reach the RTTC nearest you, call 800/642-2872.

Ken Dozier
Far West Technology Transfer Center
University of Southern California
213/743-2353

Dr. William Gasko
Center for Technology Commercialization
Massachusetts Technology Park
508/870-0042

J. Ronald Thornton
Southern Technology Applications Center
University of Florida
904/462-3913

Gary F. Sera
Mid-Continent Technology Transfer Center
Texas A&M University
409/845-8762

Lani S. Hummel
Mid-Atlantic Technology Applications Center
University of Pittsburgh
412/383-2500

Christopher Coburn
Great Lakes Industrial Technology Center
Battelle Memorial Institute
216/734-0094

David Moran
National Technology Transfer Center
Wheeling Jesuit University
800/678-6882

Doris Rouse
Research Triangle Institute Technology Applications Team
Research Triangle Park, NC
919/541-6980

NASA ON-LINE

Go to **NASA's Commercial Technology Network (CTN)** on the World Wide Web at <http://nctn.hq.nasa.gov> to search NASA technology resources, find commercialization opportunities, and learn about NASA's national network of programs, organizations, and services dedicated to technology transfer and commercialization.



Publications/Events

The National Aeronautics and Space Administration (NASA) invites eligible small business concerns to submit **Phase I proposals for its 1997 Small Business Innovation Research (SBIR) Program**, which is described in the NASA SBIR Program Solicitation. The 1997 solicitation period for Phase I proposals begins July 30, 1997 and ends October 10, 1997. NASA seeks subtopics and offering commercial application potential. This solicitation contains program background information, outlines eligibility requirements for SBIR participants, describes the three SBIR program phases, and provides the information needed for submitting responsive proposals. This year the 1997 SBIR Program Solicitation is only available via electronic means through the NASA SBIR-STTR home page, the NASA SBIR Bulletin Board system (BBS), Business Gold-NTTC On-line, FEDIX, and diskettes that NASA will provide on request. **Printed copies of the solicitation will not be distributed.**

Electronic Access to Information. Internet sites where the 1997 SBIR Solicitation and other SBIR documents can be found are:

NASA SBIR/STTR Home Page: <http://sbir.hq.nasa.gov/>

National Technology Transfer Center Home page: <http://www.nttc.edu/> ✱

Technology 2007 will be convened on September 22–24, 1997 at the Hynes Convention Center, Boston Massachusetts. For the first time this year, this annual conference and exposition will be co-located, with the

International Society for Optical Engineering's (SPIE's) Photonics East and Electronic Imaging International expositions, with total expected attendance that exceeds 10,000 with over 500 exhibits. ✱

Tap into a Billion Dollar business resource by attending the National **Small Business Innovation Research (SBIR) Conference** to be convened October 14–16 in Washington, DC and October 27–29 in Phoenix, AZ. This year the federal government will award more than \$1 billion in R&D grants to small high-tech firms. For registration information call 306/683-5742 or visit the SBIR Home Page: www.zyn.com/sbir Sponsored by the National Science Foundation, Department of Defense, and Small Business Administration, in cooperation with all SBIR federal agencies and departments. ✱

Multi-Media

NASA is releasing its 1997 version of the 'NASA Solutions' CD-ROM. This CD-ROM is a fully searchable information tool about NASA's Commercial Technology Network. It is intended to give business managers, engineers, scientists and technology transfer experts access to NASA technology resources to help solve engineering or manufacturing problems or to help create new or improved products or services. For more information please call the NTTC Gateway at (800) 678-6882 or send an e-mail from the TechTracs web page <http://www.ntas.nttc-nco.edu> ✱

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